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ABSTRACT

This article discusses how the utilization of the visual capabilities of a World Wide Web site can enhance the development of teacher curriculum design employed in graduate level education courses. In using these Web sites, teachers have an opportunity to peruse numerous visual samples as a basis for creating integrated and interdisciplinary curriculum units unique to their own subject discipline. Linkages are provided for immediately creating individualized unit models. The Web sites also provide teachers with visual samples for designing multimedia programs with graphics for K-12 classroom instructional use associated with specific integrated curriculum projects. The major sections of the paper cover the following topics: (1) objectives for integrated and interdisciplinary approaches to curriculum development; (2) a Web site constructed with selected graduate student integrated and interdisciplinary curriculum unit projects; (3) rationale for utilizing Web-based instruction; (4) use of visuals as knowledge enhancers; (5) K-12 student classroom visual examples; (6) the relationship of color visuals to student learning; and (7) static versus animated visuals. (Contains 24 references.) (Author/MES)

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# Using Visual Capabilities of the Web to Develop Curriculum Integration Concepts for K-12 Education

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## Abstract

The purpose of this article is to discuss how the utilization of the visual capabilities of a web site can enhance the development of teacher curriculum design employed in graduate level education courses. In using these web sites, teachers have an opportunity to peruse numerous visual samples as a basis for creating integrated and interdisciplinary curriculum units unique to their own subject discipline. Linkages are provided for immediately creating individualized unit models. The web sites also provide teachers with visual samples for designing multimedia programs with graphics for K-12 classroom instructional use associated with specific integrated curriculum projects.


### Introduction

As more people use Internet sites for obtaining information, the utilization of web sites for instructional purposes in the university classroom is developing at an increasingly fast rate. At one university graduate school, the use of web-based technology to serve visual literacy and instructional strategy needs for teachers in graduate level education courses constitutes a successful teaching technique. The rationale for developing the web site involves enabling teachers to view well designed integrated and inter disciplinary curriculum units and in using web examples to formulate and create curriculum units unique to individual teacher and K-12 classroom sites. A major advantage of this approach resides in the decrease of teacher time for unit design selection thereby allowing more teacher focus on devising appropriate pedagogical techniques for curriculum implementation, design of relevant student multimedia programs featuring visuals, and creation of basic games using clues to support student web-based project research. An extension of this web site provides samples for teacher use in designing motivational and instructional visuals associated with individual curriculum units for K-12 student classroom usage.

### Why interdisciplinary and curriculum integration?

The current literature on curriculum design encourages both integrated and interdisciplinary approaches to curriculum development which focuses on connecting several different subject disciplines to a common theme. Several main objectives serve as the basic premise for utilization for these approaches: (1) to provide meaningful student instruction in teaching for understanding thereby lessening the use of isolated, decontextualized information (Seely, 1995), (2) to integrate the rapidly growing wealth of course information into related units in supporting the "less is more" concept of knowledge acquisition (Jacobs, 1989), and (3) to combine related disciplines to support higher order thinking, inquiry and problem-solving instructional strategies (Erickson, 1995).

Although many curriculum texts use the terms "integrated" and interdisciplinary" interchangeably, the following characterizations are presented to clarify usage in this context. Basically, integrated curriculum serves to provide "active linkages between fields of knowledge" (Jacobs, 1955, p. 5) by generating an organizing theme or common topic which can be connected to two or three subject disciplines. One objective of this approach is to decrease fragmentation of content and foster interrelationships among the curriculum components of each subject area. Seely (1995) explains curriculum integration as:

> ...mak[ing] explicit the ways in which connections between ideas are perceived. Concepts and facts presented in one area of the curriculum, for example, language arts, are not separated from those learned in other content areas, like social studies and science...a unifying theme undergirds the connection (p. 2).

On the other hand, interdisciplinary curriculum is an extension of this concept; "[it] refers to a variety of disciplines [usually four or more subject areas] sharing a common, conceptual focus...theme, problem, or issue" (Erickson, 1995, p. 96). Common curricular strands revolving around the major theme or organizing concept are selected from each subject discipline.



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To support student understanding of the connections between subject areas, it is essential to devise instructional activities which are embedded in cognitive strategies to encourage student engagement in learning such as inquiry, critical thinking, and problem-based learning. The goal of both approaches is to "illuminate more clearly the concept[s] under study in relation to a significant theme..., through the application of higher level thought processes as students analyze, synthesize, and generalize from information to knowledge" (Erickson, 1995, p. 96). To assist teachers in graduate level education classes in designing either integrated or interdisciplinary curriculum units, utilization of examples on an interdisciplinary web site serve to help teachers more rapidly gain basic conceptual designs thereby permitting focus on devising relevant instructional strategies to enhance student understanding.

**A web site description**

This article depicts a web site constructed with selected graduate student integrated and interdisciplinary curriculum unit projects. Prior to development of the web site, graduate education students designed curriculum units based solely on an outline provided by the instructor. Primarily, student time was spent in selecting a model from available options in texts, gaining an understanding of designing appropriate model components, creating relevant thematic connections, and devising good instructional strategies to support the relationships established among subject areas. In reflecting on graduate student accomplishment of course objectives, the instructor determined that course focus necessitated more time spent on expanding meaningful teaching techniques appropriate for individual student classrooms such as use of creative/critical thinking and problem solving skills rather that time on developing integrated and interdisciplinary curriculum design model components. Therefore, development of a web site for student critical review during graduate level class time and individual access at home on in the computer lab enables graduate education students to focus on those strategies which would enhance K-12 student classroom understanding of content.

The introduction to the web site defines the uses of models of integrated and interdisciplinary curriculum designs. Samples of integrated and interdisciplinary curriculum units represent graduate education student work based on their interpretation of curriculum designs advocated by Heidi Hayes Jacobs ("Interdisciplinary Curriculum: Design and Implementation") and instructional strategies suggested by Robin Fogarty ("Best Practices for the Learner-Centered Classroom") and Lynn Erickson ("Stirring the Head, Heart, and Soul: Redefining Curriculum and Instruction"). Some curriculum unit examples feature charts based on Bloom's Taxonomy" or Jacobs' "Problem-Solving Matrix." The web site consists of a variety of designs, diagrams, models, and pedagogical information which is available for immediate teacher usage in making essential adaptations to individualized curriculum unit design. Almost all projects feature a variety of webbed type models depicting the connection subject disciplines; the guiding questions aligned with each subject area serve to provide relevancy to the central theme. Linkages are provided to access to featured individual curriculum units, webbed models, teacher directions, and sample student multimedia instructional programs.

**Rationale for utilizing web based instruction**

Several reasons exist for the selection of web based instruction as a teaching strategy for graduate education classes. One rationale is the result of instructor reflection on desired course outcomes. It was determined there are three basic reasons for selecting web-based units as a strategy to assist in graduate level knowledge attainment. These constitute the theoretical basis for cognitive learning, knowledge transfer processes, and use of visuals to facilitate knowledge acquisition. In a brief overview of the cognitive learning processes, characteristics of learners include comprehension viewed as the ability to "make inferences and assumptions bases on...[prior] knowledge" and the "relationship between comprehending and remembering" (Bransford, 1979 in Koszalka et. al., 1997, p. 73). These processes enhance individual capability to transfer and apply knowledge from one situation to another; it is within these processes that learned content can be identified. According to Gagne, et al. (1993), among the several factors that contribute to successful knowledge transfer are degree of learner comprehension of task, learner ability to evaluate selected strategies, and degree of learner understanding of strategy

application. In support of these concepts, Driscoll (1994) claims that cognition is contextually situated therefore learning tasks should be both meaningful and easily transferable to the environment in which it will be used. In the case of graduate level teacher usage of web-based curriculum units, both assigned tasks and intended context represent the basis for successful engagement in project curriculum unit design.

Another rationale which validates the creation of the web site resides in the impact of formulating a relationship between cognitive processes and visual perceptions. Cognitive processes are continuously influenced by a variety of contextual factors which may either enhance or detract from achieving a desired instructional goal. Therefore to improve student comprehension, whether at the graduate or grade school classroom level, it is essential to employ some type of strategy to lessen distractions. In this age of technology, numerous "cognitive tools" are available to assist in focusing student attention on interpreting information, analyzing content, manipulating mathematical and scientific factors, and creating practical representations of knowledge (Jonassen and Reeves, 1996). One such "cognitive tool" may be identified as the use of a web site database and "construction software" (Koszalka et al., 1997) both as a research device and a creative medium. Usage of these "cognitive tools" through design of appropriate visuals (diagrams charts, etc.) assists graduate students in structuring and representing their understanding in adapting curriculum design and pedagogical strategies to particular types of classroom student needs. Grade school students likewise benefit from using computer instructional programs directed toward learning activities and motivational experiences (Papert, 1993). One major advantage of the site is that it is comprised of numerous sample designs with informative content and navigational linkages to enhance teacher construction of curriculum models for individual classroom student needs in curricular, instructional, and motivational arenas. In addition, there is a practical aspect of accessing the web site at times convenient to the graduate student.

**Use of visuals as knowledge enhancers**

A major contributor to the web-based environment consists of the visual appeal of the web site design. Alternation of printed text, charts, and diagrams assist in focusing learner attention (Pettersson, 1997a) and engagement in critical review of curriculum projects for application in creating individual projects. Using charts and diagrams may be viewed as a form of "information graphics", the purpose of which is to emit concise messages; "factual graphics" and "instructional graphics" represent two identifiable classifications relevant to this discussion (Pettersson, 1997b, p. 54). The objective of this usage is to provide an overall view of detailed information within a "limited subject field" (p. 54).

Koszalka et al., (1997) view visual literacy as "enhancing the construction of a learner's experience" (p. 75). They cite the physical layout with its relationships among text, symbols, and images as providing the comprehension of the message to be conveyed. Akin to the curriculum project task for graduate education students is the creation of one's "own meaning based on perceived interpretations" (p. 75), which is afforded through sample visuals existing in the web site curriculum units. Employing visuals reportedly assists "learners in contextualizing concepts into a frame of reference that facilitate concept acquisition" (p. 76). In order to spend a major portion of the preparation time to concentrate on identifying and selecting the most appropriate instructional strategies essential for K-12 student classroom use, it is important to use as little time as possible in devising components for curriculum model designs.

The use of web based navigation tools in the form of linkages assists the graduate student in accessing relevant information easily thereby enabling concentrated focus on the tasks of creating a well-designed integrated curriculum unit. This web site observes two basic rules in developing web hypertext environments as established by Grabinger (1993). One rule requires consistency in the organizational design of menus, buttons, and other navigational aids which are placed on the web site. The second rule consists of those components which enable the viewer to identify "component parts to the site and the screens within the site"; these include headings, captions, pictures, etc. (Koszalka et al., 1997, p. 76). And finally, employing a variety of overlapping window formats permits a viewer to easily shift windows to gain information from different sections of the web site (Benshoof and Hooper, 1993).

**K-12 Student Classroom Visual Examples**

Essential in expanding the usages of the Integrated/Interdisciplinary Curriculum Unit web site is the addition of sample classroom projects which teachers in graduate education courses can utilize as a basis for designing K-12 student motivational and instructional computer programs aligned with their curriculum unit theme. On the current web site, three examples are provided to encourage designing different types of visual graphics. A simplistic example exists in the unit entitled "People and Their Work" (Kerry Moran, in Johnson, 1997) wherein kindergarten students are directed to identify the different types of work displayed the visual animations by activating the correct "button". The latter task enables the kindergarten child to display an understanding of the type of work associated with the displayed visual; since descriptive words also appear, kindergartners begin to associate word and picture. Animation, as used here, is not extensive and primarily assists in maintaining student interest and attention. Although the basic underlying intent of this example is to teach word-picture association, other learning objectives include retention of information and motivational devices as instructional strategies.

The interdisciplinary curriculum unit entitled "Discovery and the Solar System" (Maris Gehris), intended for grade three students demonstrates the use of visuals to support student web based research. This unit integrates common themes of the school's curriculum in the disciplines of language arts, science, mathematics, and social studies. Graphics displayed in the student section of the unit are designed to assist in selecting information to complete individual web-based research assignments such as the creation of planets within a simulated solar system. Students are asked to identify the characteristics of a "make-believe" planet, its size and depth, its distance from the sun, its possibility for supporting human life, etc. The purpose is more motivational than instructional yet is serves to reinforce basic concepts as students engage in web- based research projects.

**The relationship of color visuals to student learning**

Chen (1997) relates the existence of two features using visuals, (Dwyer, 1978, Fleming, 1978, etc.) which are attributed to influencing learner processing of visual information: these are "color and background information" (p. 40). Most notable is Pruisner's claim (1993) that the use of color had a positive impact on the recall of verbal information presented in graphic form. This conclusion was the opposite of Livingston's finding (1991) that color sometimes appears to be a distraction to learning; students recall the color but not the object of its usage. Dwyer (1982), in later studies found the effects of color graphics as having an important role in improving student achievement. According to Chen's interpretation, the effects of color in relationship to student knowledge attainment, especially aligned with learner age, is still inconclusive.

Variables such as learner's age, color distractions, degree of motion in animation, etc. are always to be considered in examining the effectiveness of using static or animated graphics. These factors should be included in future studies of the impact of these variables on the relationship between the use of visuals and improved student learning.

**Static versus animated visuals**

The research literature acknowledges that both still and animated visuals have a positive impact on student learning (Park & Hopkins, 1993; Rieber, 1990; Levin, et. al., 1987). The examples of static visuals found in the curriculum unit on "Discovery of the Solar System", in their relevance to the instructional content, can be viewed as effective "mnemonic aids" which sustain student retention of factual information (Anglin, 1997). In creating the visuals, consideration is given to uses of color, page position, style and realistic effects with the purpose of enhancing student learning despite nonsupportive research findings. Classroom teachers in graduate education courses, however, hold the belief of an existent relationship between the use of static visuals and some degree of student factual retention. In using animated graphics, curriculum unit designers prepare visuals anticipating improved learning among K-5 students. Researchers conclude that facilitation of learning may exist but probably in the presence of specific conditions. Briefly, the conditions cited by Rieber (1990) and Park and Hopkins (1993) are: (1) the congruency of text content with selected visual animated graphics, (2) the degree of animated motion intended for focusing learner attention on learning tasks, and (3) the presentation of

complex material necessitates visual images to enable the learner to form "internal visual images" (Anglin, et. al., 1997, p. 27). Anglin and his colleagues conclude that many studies citing the use of both static and animated visuals fail to provide a clear relationship of their role in effective student learning. However, including either static or animated graphics necessitates examining the functional role to be assumed in providing better student understanding of content.

In conclusion, this article has described the rationale for the establishment and usage of a web site on integrated/interdisciplinary curriculum units with K-12 classroom graphics addendums. The creation of this web site, as a result of a teaching grant from a graduate university campus, enables graduate education students (who are mainly classroom teachers) to design and develop curriculum which reflects the needs of their students and current school environment. The main thrust of designing a web site to teach basic concepts thus allowing concentration on development of pedagogical techniques to engage student learning appears to be, according to graduate student reports, a successful instructional strategy for graduate level curriculum courses. The addition of a K-12 sample site to encourage further graduate student program design should serve to motivate more teachers to become graphics designers of programs for their own classrooms. Overall, the existence of this web site has already produced more focused interdisciplinary curriculum projects which will serve to further enhance the relationship of technological use in educational practice.

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